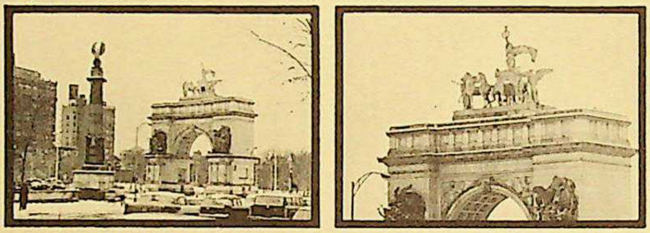
Minolta
Technical
Bulletin
No. 7

# Telephotography with Minolta Rokkor Lenses

Telephoto lenses have three major purposes:

1. To get you "closer" to inaccessible objects.
2. To keep you a safe distance from dangerous objects and situations.
3. To modify perspective for esthetic purposes.

As you know, a telephoto lens is designed to photograph subjects in larger scale. This is invaluable when we can't approach distant landmarks, buildings and wary subjects. Nature photography would be almost impossible without the use of telephotos. Magnifications to 20X your "normal" lens with Minolta Tele Rokkors effectively put you "on top of the action." For the same reasons, photographers select telephotos when shooting hazardous events or dangerous subjects.



NORMAL AND TELEPHOTO SHOTS OF SAME SUBJECT, FROM SAME POINT, SHOW DIFFERENCE IN ANGLE OF COVERAGE

Another very important aspect of telephotography is the apparent effect these lenses have on perspective. We say apparent because there is nothing inherent in telephoto design that changes perspective. It's actually a question of viewpoint. Because we can move further away from our subject, the objects that would be in the foreground with a "normal" lens are now much further away and are less prominent in relation to the background. A camera lens is a literal recording device and has no recourse to psychological corrections as does the human eye. We know the relative size and distance of objects from past experience, but the camera lens can't shift its attention back and forth between two points; it obeys only optical laws. Because telephotos are used further from the subject than "normal" lenses, the apparent difference between near and far objects is reduced. Result: to see telephoto pictures in "proper" perspective, we must back away for more than the usual 10″ or 12″ viewing distance. The basic rule is that proper perspective will be observed when the print is viewed at a distance equal to the lens focal length multiplied by the enlargement multiple. (Enlargement "multiple" is equivalent to the number of times the negative is enlarged compared to its normal size. For example, an enlargement multiple of "8" means simply that the enlarged print is 8 x 10″ and eight times bigger than the 1 x 1½″ original negative.) Following this rule, we would view an 8 x 10″ enlargement of a picture taken with a 200mm lens at a distance of 6 inches (focal length) multiplied by 8 (enlargement multiple): 48 inches viewing distance for correct perspective. We should also remember that focal length has no effect on perspective, but that the distance from the camera to the subject does.

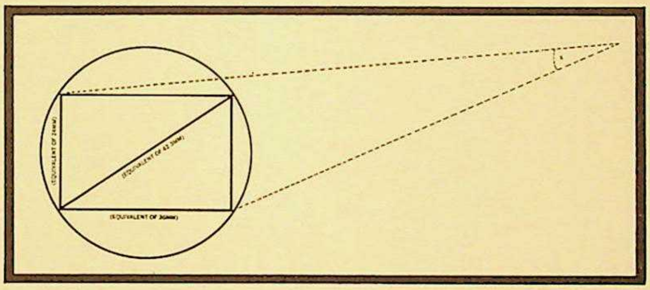
55MM AND 135MM PORTRAITS OF SAME SUBJECT

One of the most important applications for medium telephotos is the use of the 100mm and 135mm Rokkor lenses for portraiture. Here, the special advantages of telephotos includes a longer working distance from the subject which compensates for the exaggeration of those features that are usually closest to the lens (nose, ears and chin). This "compression" of depth becomes more noticeable with increasing focal lengths so that the 100mm Rokkor is most generally accepted for portraiture. Again, keep in mind that perspective control is a function of the distance between camera and subject.

Another telephoto characteristic is its restricted angle of view. This refers to the amount of a scene included in our picture. Modern optical designers have produced lenses covering angles from such extremes as 100° to as little as 2°. Our concern here is with lenses yielding angles less than 43°, which is the angle of coverage of the standard 55mm Minolta Rokkor.

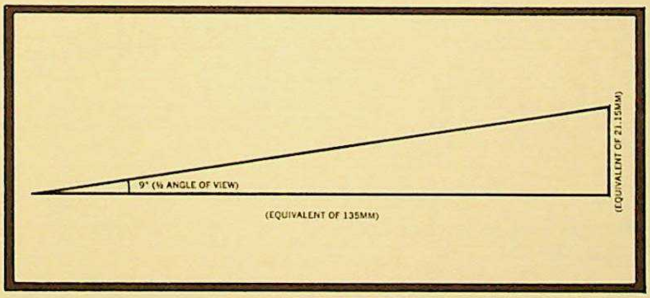
## How is angle of view determined?

First let us visualize this measurement in the following diagram.



"ANGLE X"

Angle X is the full angle of view that covers our frame, edge to edge, with an image circle diameter equal to the diagonal of the negative. To determine "Angle X", we use the "Half Angle" method.




HALF ANGLE METHOD

Using this method, we find the actual angle of view by drawing a base whose length is equal to the lens focal length (for example a 135mm lens as shown in the diagram). With a square we erect a line equal in length to half the diagonal of our 35mm frame.

This is 21.15mm (42.3mm divided by 2). This will form an angle equal to one half the angle of view, in this case 9°. The angle of view for a 135mm lens and full frame 35mm cameras is therefore 18°. There is a direct relationship between focal length and image magnification, and an inverse relationship between focal length and angle of view. For example, a 100mm lens gives us approximately twice the image size of a "normal" lens but one half the angle of view.

You will soon discover that telephoto lenses have a comparatively shallow depth-of-field. This depth decreases as the focal length increases, providing the diameter of the circle of confusion is specified as a fraction of the focal length. ("Circle of confusion" is explained on the reverse side.)

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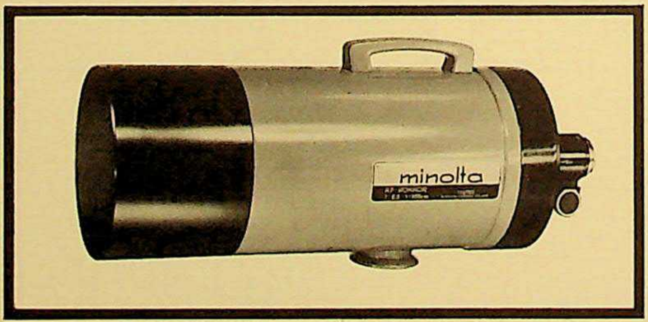
# What is Depth-of-Field?

Light rays from different distances in a scene will resolve to a point at different planes in front of and behind the film. When we focus at 10 feet, light from that distance will focus to a definite point on the film. Objects closer or more distant cannot resolve to the same point and actually resolve as small circles because their point of resolution is either behind or in front of the film. The closer objects are to the focus point (in this case 10 feet), the smaller the diameter of these circles, which are known as "circles of confusion." Depth-of-field is the range of acceptable sharpness on either side of a given focus . . . based on an accepted diameter for a circle of confusion. The larger the diameter of these circles we are willing to accept on our exposed negative, the greater the depth-of-field. For practical purposes, the circle of confusion diameter can be 1/100th inch for viewing prints at the "normal" 10" distance. Critical sharpness would require a 1/200th inch diameter. For bigger enlargements, the diameter can be greater since we would be viewing the prints from greater distances. In terms of focal length, the circle of confusion should be approximately 1/1000th the lens focal length for acceptable sharpness. Also, the smaller the aperture we use, the smaller will be the entering cone of light and the greater the percentage of acceptable circles of confusion; in other words greater depth-of-field.

# Pre-set and Automatic Lenses

Minolta makes both pre-set and automatic diaphragm lenses in the telephoto series. In both cases the aperture is selected by setting an index mark to the appropriate "f" stop. On pre-set lenses there are two aperture rings placed at the front of the lens. One is set to the required "f" stop, and the other, when rotated, travels from full aperture to the "f" stop set on the other ring. We can focus and view full open and then close down without looking at the lens barrel. The fully automatic lenses feature a diaphragm that is always open to maximum aperture except for the instant of exposure. A lever control permits previewing the depth-of-field without interfering with the automatic operation of the lens. The internal coupling of fully automatic Rokkor telephotos is accomplished by means of a travelling metal finger at the bottom of the lens mount opening. This part is linked to the shutter cocking mechanism and sweeps from left to right in a direction parallel to the film plane. As it moves it contacts and carries along with it a spring loaded pin at the back of the lens itself. This pin is connected to the diaphragm. At maximum travel to the right, the lens closes down to the preselected "f" stop and opens to full aperture with the return of the finger. At slow speeds, up to 1/30th sec., with the lens removed, watch the finger travel when the shutter is released. It must move a specific distance and back in synchronization with the flip of the mirror and the sweep of the focal plane shutter. Now release the shutter at a speed of 1/500th sec. or 1/1000th sec.; the whole sequence takes place in the wink of an eye. These parts must be built for rugged duty and a tremendous number of cycles. In the popular 100mm, 135mm and 200mm focal lengths, Minolta makes pre-set and automatic diaphragm lenses. In these focal lengths, the pre-set lenses are of medium speed (f/4 and f/5) and light in weight. Other than their slower operating speed and dim light limitations, these lenses are optically superb and make very economical additions to your camera outfit.

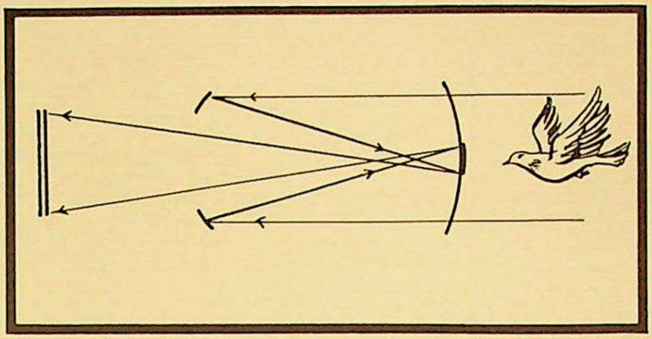
There are any number of inexpensive telephoto lenses available which with adaptation will fit your Minolta SR camera. Their optical design, in the main, is of the simplest type, lacking adequate correction for distortion and color photography. They may consist of as few as two elements, especially in the longer focal lengths. While their central image may be sharp, resolution generally falls off rapidly to the edges of the frame. Your Minolta SR camera is a precision instrument, the full capabilities of which can be realized only with Rokkor lenses specially designed for it.




1000MM LENS

The most recent addition to the Minolta telephoto lens series is the 1000mm f/6.3 Rokkor. This unusual lens utilizes precision mirrors rather than conventional elements in its design. Light travels through the lens three times resulting in a folded optical path for a relatively compact system with an extremely long focal length.

LIGHT PATH FOR 1000MM LENS



This schematic illustrates the light path of a typical mirror (catadioptric) lens. Note how mirrors are used to lengthen the light path within a relatively short physical length.

Because the diameter of this lens is so large, a filter turret is built into the lens which permits special filters to be inserted. Four are provided with the lens, the Y48, 0, R60 and UV. An additional revolving turret which houses three neutral density filters is also provided to give the equivalent of f/stops by cutting down the amount of light. The first position has no filter, thereby allowing all the light to enter for an equivalent aperture of f/6.3. This is followed by f/11, f/16 and f/22.

| Lens | Angle of View | Filter Diameter | Minimum Focus | Weight | Accessories |
|---|---|---|---|---|---|
| 100mm f/2** | 24 | 62mm | 4′ | 14.9 oz. | Lens Hood & Leather Case |
| 100mm f/3.5** | 24 | 55mm | 4′ | 10.9 oz. | Lens Hood & Leather Case |
| 100mm f/4* | 24 | 46mm | 4′ | 7.8 oz. | Lens Hood & Leather Case |
| 135mm f/2.8** | 18 | 55mm | 5′ | 1 lb. 3 oz. | Lens Hood & Leather Case |
| 135mm f/4* | 18 | 46mm | 5′ | 13.4 oz. | Lens Hood & Leather Case |
| 200mm f/3.5** | 12 | 67mm | 7′ | 1 lb. 11 oz. | Lens Hood & Leather Case |
| 200mm f/5* | 12 | 52mm | 8′ | 1lb. ¾ oz. | Lens Hood & Leather Case |
| 300mm f/4.5* | 8 | 77mm | 15′ | 2 lb. 12 oz. | Lens Hood & Leather Case Also, Special Tripod Available |
| 600mm f/5.6* | 4 | 126mm | 40′ | 10 lb. 7 oz. | Lens Hood & Wooden Case Also, Special Tripod Available |
| 1000mm f/6.3 (ND filters) | 25 | | 100′ | 21 lbs. | Lens Hood & Wooden Case Also, Special Tripod Available |

*pre-set diaphragm **automatic diaphragm

The above table shows that as the focal length of these telephotos increases, there is an increase in the minimum focusing distance. The closer a lens is focused, the greater its extension from the camera mount. In the case of the 300mm Rokkor, which can be focused as close as 15′, any further extension would make the lens quite clumsy and would lengthen the light path enough to require extensive "f" stop recalculations. For this reason close-up attachments are sometimes used when a long focus lens must be brought closer to the subject. The lens should be closed down to f/11 or f/16 in this application.

The most important requirement for successful telephoto pictures is steadiness. The camera should, if possible, be braced against a tree, wall or other support. If a tripod is too bulky when travelling, a number of small clamp-on units are available which will attach to almost any convenient projection. With practice though, you should be able to hand hold exposures with lenses to 200mm at fast shutter speeds. For the Rokkor 300, 600 and 1000mm lenses, a special tripod is available which actually supports the lens directly, rather than the camera.

In ordinary photography we try to set our diaphragm for as much depth-of-field as possible. A telephoto's restricted depth, however, can be used to advantage. Backgrounds are easily blurred out of recognition, and in color photography especially, an almost even toned background will help to set off our subject to best advantage.

When using longer telephotos for distant scenes, there may be an obscuring haze between you and the subject. In some cases you can cut through this haze with a red filter. If we wish to shoot with a red filter and infrared film, the longer wave lengths require compensation for proper focus. Because infrared rays come to a focus behind the film, and they are invisible in visual focusing, Minolta provides a special index mark (R) on all Rokkor telephoto lenses. In general, long distance telephotography is characterized by somewhat reduced contrast. The movement of the atmosphere and light scatter from airborne dust particles all tend to compress our contrast range. It will become necessary then to underexpose and overdevelop your negatives and/or print on a higher contrast paper.

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